UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH ADMINISTRATION
BUREAU OF ANIMAL INDUSTRY
AND COOPERATING STATES

ELEVENTH ANNUAL REPORT OF THE

WESTERN SHEEP BREEDING LABORATORY

DUBOIS, IDAHO

JUNE 30, 1948

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ANNUAL REPORT
Western Sheep Breeding Laboratory
June 30, 1948

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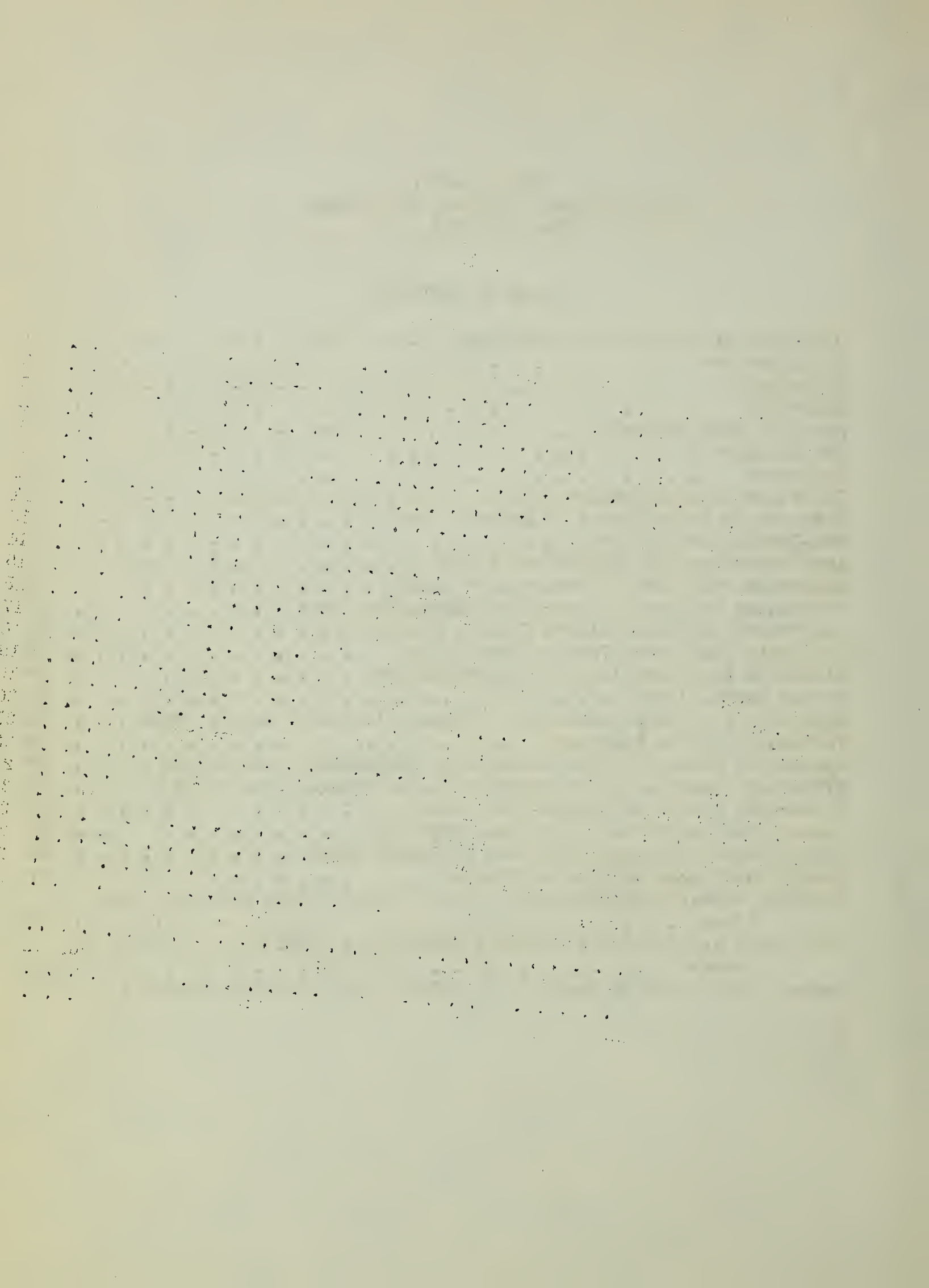

DIRECTORS OF STATE AGRICULTURAL EXPERIMENT STATIONS
OF THE TWELVE WESTERN STATES THAT ARE COLLABORATING
WITH THE WESTERN SHEEP BREEDING LABORATORY

ARIZONA:	P. S. Burgess, University of Arizona, Tucson.
CALIFORNIA:	C. B. Hutchison, University of California, Berkeley.
COLORADO:	H. J. Henney, Colorado State Agricultural College, Fort Collins.
IDAHO:	Donald R. Theophilus, University of Idaho, Moscow.
MONTANA:	Clyde McKee, Montana State College, Bozeman.
NEVADA:	C. E. Fleming, Nevada Agricultural Experiment Station, University of Nevada, Reno.
NEW MEXICO:	Dr. Harry R. Varney, Director ~~A. S. Curry~~, Acting Director, New Mexico State College of Agriculture, State College.
OREGON:	W. A. Schoenfeld, Oregon State College, Corvallis
TEXAS:	R. D. Lewis, Agricultural and Mechanical College of Texas, College Station.
UTAH:	R. H. Walker, Utah State Agricultural College, Logan.
WASHINGTON:	Mark T. Buchanan, Washington State College, Pullman.
WYOMING:	J. A. Hill, University of Wyoming, Laramie.

COLLABORATORS OF THE WESTERN SHEEP BREEDING LABORATORY

ARIZONA: Ernest B. Stanley, Head, Department of Animal Husbandry, College of Agriculture, University of Arizona, Tucson.

CALIFORNIA: James F. Wilson, Division of Animal Industry, College of Agriculture, University of California, Davis.

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MONTANA: J. L. Van Horn, Department of Animal Husbandry, Montana State College, Bozeman.

NEVADA: Charles E. Fleming, Director, Nevada Agricultural Experiment Station, University of Nevada, Reno.

NEW MEXICO: Philip E. Neale, Department of Animal Husbandry, New Mexico College of Agriculture and Mechanic Arts, State College.

OREGON: F. F. McKenzie, Chairman, Department of Animal Husbandry, Oregon State Agricultural College, Corvallis.

TEXAS: Bruce L. Warwick, ~~Department of~~ Animal Industry, Texas Agricultural Experiment Station, ~~College Station~~. Bluebonnet Farm, McGregor, Texas

UTAH: Louis L. Madsen, Head, Department of Animal Husbandry, Utah State College, Logan.

WASHINGTON: M. E. Ensminger, Head, Department of Animal Husbandry, State College of Washington, Pullman.

WYOMING: Elden K. Faulkner, Department of Animal Production, College of Agriculture, University of Wyoming, Laramie.

ROSTER OF PERSONNEL

WESTERN SHEEP BREEDING LABORATORY AND U. S. SHEEP EXPERIMENT STATION
Dubois, Idaho
June 30, 1948

Name	Rating	Date Entered on Duty	General Duties
Nordby, Julius E.	Animal Husbandman	Mar. 1, 1938	Director
Terrill, Dr. Clair E.	Animal Husbandman	July 3, 1936	Genetics and Physiology
Stoehr, John A.	Animal Husbandman	Aug. 28, 1928	Operations
Emik, Dr. L. Otis	Animal Husbandman	July 7, 1941	Physiology and Genetics
Watkins, Jr., Thomas D.	Animal Fiber Technologist	Aug. 4, 1947	Wool Technologist
Wilson, Lowell O.	Foreman of Farm Laborers	July 1, 1943	Assistant, Operations
Schaefer, Chester F.	Clerk	June 22, 1936	Chief Clerk
Hensley, Gladys L.	Clerk	Aug. 4, 1947	Clerk
Taylor, Jessie S.	Clerk	Aug. 25, 1947	Clerk
Watkins, Miriem R.	Calculating Mach. Operator	June 14, 1948	Calculating Machine Operator
Jeffery, Lee C.	Foreman of Farm Laborers	June 7, 1924	General Maintenance, Pumps, Equipment
Rasmussen, Jr., Henry	Farm Laborer	July 1, 1926	Sub-Foreman
Anderson, Daniel	Farm Laborer	Aug. 4, 1947	Shepherd
Goldman, James R.	Farm Laborer	May 1, 1939	Shepherd
Hohman, Max E.	Farm Laborer	April 1, 1935	Shepherd
Howard, John H.	Farm Laborer	Oct. 2, 1944	Camp Tender
Ingram, Parley F.	Farm Laborer	Apr. 20, 1947	Shepherd
Phillips, Walter H.	Farm Laborer	Mar. 16, 1935	Truck Driver
Powell, Fred A.	Farm Laborer	May 11, 1935	Teamster
Swink, Albert B.	Farm Laborer	May 31, 1946	Farm Laborer
Nantz, Mrs. Dorinda R.	Laborer	June 16, 1941	Janitress and Cook

OBJECTIVE

The main objective of this Laboratory is to improve sheep for lamb and wool production under range conditions. In the pursuit of this objective basic breeding methods are employed; heritability analyses are made of the various utility factors, and the selection of breeding animals is based upon production as that is measured under range environment. Emphasis is placed primarily on the quantity and quality of lambs produced; the length, quality and quantity of clean scoured wool, and upon the adaptability and longevity of the sheep.

RESEARCH LINE PROJECTS

1. Development of systems of breeding for locating strains of Rambouillet sheep which may possess combinations of genes that will improve strains with which they may be crossed. This research line project includes:

    (a) The development of inbred strains or lines by the mating of animals as closely related as possible or desirable, and with emphasis on selection for all characters of economic importance.
    (b) The development of inbred lines with special reference to very important characters that are of economic importance to range sheep, such as mutton form, length of staple, and faces that are free from excess wool covering causing wool blindness.
    (c) The development of a non-inbred control group.

2. Determination of the inheritance of various undesirable characteristics of Rambouillet sheep, such as abnormalities in the growth of wool, hairiness in fleeces of wool and excessive skin folds or wrinkles, for the purpose of developing methods of breeding by which these undesirable characteristics may be eliminated from the stock.

3. Studies in the physiology of reproduction of Rambouillet sheep as they may contribute to the program of the Western Sheep Breeding Laboratory, including:

    (a) Sexual maturity of Rambouillet ram lambs;
    (b) Quality of semen in relation to fertility; and
    (c) Factors affecting fertility of ewes.

4. Studies in the physiology of wool production of Rambouillet sheep, including reference to fiber uniformity within and between various regions of the fleece in relation to the total uniformity of the fleece.

5. Analysis of records of the characteristics of sheep and wool to determine the usefulness of such records in the program of the Western Sheep Breeding Laboratory.

PUBLICATIONS

The following papers have been published or mimeographed since the beginning of the Western Sheep Breeding Laboratory in 1937. The complete list is included again this year for your convenience. Only the publications contributed to by the Western Sheep Breeding Laboratory are included in this list. Those publications which were also contributed to by the U. S. Sheep Experiment Station are starred. A number of contributions have been made to livestock journals and the general press that are not included in this series. The y are for tho most part adaptations of the regular series but rewritten for the lay reader.

5. Reproductive Capacity of Rambouillet Ram Lambs as Indicated by Semen Tests. C. E. Terrill, Proc. of the Amer. Soc. of An. Prod., 1938, pp. 308-310.

* 6. A Preliminary Study of the Relation Between Fleece Characteristics of Weanling and Yearling Range Sheep. W. V. Lambert, J. I. Hardy and R. G. Schott, Proc. of the Amer. Soc. of An. Prod., 1938, pp. 298-303.

* 7. Reproduction in Range Sheep. C. E. Terrill and John A. Stoehr, Proc. of the Amer. Soc. of An. Prod., 1939, pp. 369-375.

* 8. Selection of Range Rambouillet Ewes, C. E. Terrill, Proc. of the Amer. Soc. of An. Prod., 1939, pp. 333-340.

* 9. Comparison of the Accuracy of Two Methods of Estimating Fineness of Wool Fibers. Ralph W. Phillips, R. G. Schott, J. I. Hardy and H. W. Wolf, Jour. of Agr. Res. 60(5):343-350, Mar. 1, 1940.

*11. The Western Sheep Breeding Laboratory and U. S. Sheep Experiment Station. Julius E. Nordby. Extension Animal Husbandman, Sept., 1940.

12. Genetics and Range Sheep Improvement. Julius E. Nordby. Scientific Monthly 51:310-320, Oct., 1940.

*14. The Application of a Rapid Comparator Method for determining Fineness and Variability in Wool. Elroy M. Pohle, Proc. of the Amer. Soc. of An. Prod., 1940, pp. 161-168.

*16. Growth in Corriedale and Rambouillet Sheep under Range Conditions. Ralph W. Phillips, John A. Stoehr and G. W. Brier, Proc. of the Amer. Soc. of An. Prod., 1940, pp. 173-181.

*17. Sheep Improvement for Range Production. Julius E. Nordby, Idaho Forester 23, 1941, Forestry School, University of Idaho.

18. A Rapid Method for expressing Medullation in Wool. Elroy M. Pohle, A.H.D. No. 41, May 1941, 6 pp. (Processed).

21. Face Covering in Range Sheep. Clair E. Terrill. A.H.D. No. 49, Nov., 1941, 9 pp. (Processed).

*22. Wool Yield Determination in which Small Samples are Compared with Whole Fleeces. Ralph G. Schott, Elroy M. Pohle, Damon A. Spencer, and Glenn W. Brier, A.H.D. No. 50, Jan., 1942, 6 pp. (Processed).

*23. Wool Yields in the Small Side-Sample as Related to Individual Whole Fleece Yields in Four Breed-Groups of Sheep. Ralph G. Schott, Elroy M. Pohle, Damon A. Spencer and Glenn W. Brier, Jour. of An. Sci. 1(2):137-144, May 1942.

*24. The Importance of Body Weight in Selection of Range Ewes. Clair E. Terrill and John A. Stoehr, Jour. of An. Sci. 1(3):221-228, Aug., 1942.

*25. Relationship Between Weanling and Yearling Fleece Characters in Range Sheep, Elroy M. Pohle, Jour. of An. Sci. 1(3):229-235, Aug., 1942.

*26. Staple Length in Relation to Wool Production. Elroy M. Pohle and Henry R. Keller, Jour. of An. Sci. 2(1):33-41, Feb., 1943.

27. Improving Rambouillet Sheep for Western Ranges. Julius E. Nordby, National Wool Grower 33(3):12-7, Mar., 1943.

*28. Staple Length and Its Influence on Shrinkage and Fleece Values. Elroy M. Pohle and Henry R. Keller, National Wool Grower 33(6):22-24, June, 1943.

30. Sampling and Measuring Methods for Determining Fineness and Uniformity in Wool. Elroy M. Pohle, L. N. Hazel and H. R. Keller, U.S.D.A. Circular 704, August 1944. Revised March 1947.

31. Wool Fineness in Eight Sampling Regions on Yearling Rambouillet Ewes. Elroy M. Pohle and R. G. Schott, Jour. of An. Sci. 2(3): 197-208, Aug., 1943.

32. Clean Wool Yield Variation Among Regions of Rambouillet Fleeces, Elroy M. Pohle, H. W. Wolf and Clair E. Terrill, Jour. of An. Sci. 2(3):181-187, Aug., 1943.

33. Fiber Density and Some Methods of its Measurement in the Fleeces of Rambouillet Sheep. H. W. Wolf, W.M. Dawson and E. M. Pohle, Jour. of An. Sci. 2(3):188-196, Aug., 1943.

*34. Estimation of Clean-Fleece Weight from Grease-Fleece Weight and Staple Length. Clair E. Terrill, Elroy M. Pohle, L. Otis Emik, and Lanoy N. Hazel, Jour. of Agr. Res. 70(1):1-10, Jan. 1, 1945.

*35. Clean-Wool Yields in Small Samples from Eight Body Regions as Related to Whole-Fleece Yields in Four Breeds of Sheep. Elroy M. Pohle and L. N. Hazel, Jour. of An. Sci. 3(2):159-165, May, 1944.

*36. Shrinkage and Value by Grades for 1943 Range Wool. Elroy M. Pohle and Henry R. Keller. National Wool Grower 34(6):22-23, June, 1944. (Published in other Wool Growers Magazines)

*37. Some Factors Affecting the Blood Phosphorus Level of Range Ewes. W. M. Beeson, Clair E. Terrill and D. W. Bolin, Jour. of An. Sci. 3(2):175-182, May, 1944.

*38. The Accuracy of Measurements and Weights of Sheep. Ralph W. Phillips and John A. Stoehr, Jour. of An. Sci. 4(3):311-316, Aug., 1945.

*39. Monthly Changes in Fineness, Variability and Medullation in Hairy Lambs. Elroy M. Pohle, H. R. Keller and L. N. Hazel, Jour. of An. Sci. 4(1):37-46, Feb., 1945.

40. More Profit in Open Face Ewes. Clair E. Terrill, Mont. Wool Grower 18(1):13, 47. Jan., 1944. (Published in other Wool Growers Magazines)

*41. The Influence of Location and Size of Sample in Predicting Whole-Fleece Clean Yields. E. M. Pohle, L. N. Hazel and H. R. Keller, Jour. of An. Sci. 4(2):104-112, May, 1945.

*42. Wool Off-Sorts, Percentage, Shrink, Value. Elroy M. Pohle and Henry R. Keller, Montana Wool Grower 18(6):7, June, 1944. (Published in other Wool Growers Magazines)

43. Effectiveness of Selection on Progeny Performance as a Supplement to Earlier Culling in Livestock. G. E. Dickerson and L. N. Hazel, Jour. of Agr. Res. 69(12):459-476, Dec. 15, 1944.

*44. Looking Forward, The Stabilizing Influence of Research in a Changing Sheep Production Economy. Julius E. Nordby, National Wool Grower 35(6):18-19, 35-36, June, 1945.

45. The Etiology and Inheritance of Inequalities in the Jaws of Sheep. J. E. Nordby, C. E. Terrill, L. N. Hazel and J. A. Stoehr, Anat. Rec. 92(3):235-254, July, 1945.

46. Effects of Some Environmental Factors on Weanling Traits of Range Rambouillet Lambs. L. N. Hazel and Clair E. Terrill, Jn. of An. Sci. 4:331-341, Nov., 1945.

47. Heritability of Weaning Weight and Staple Length in Range Rambouillet Lambs. L. N. Hazel and Clair E. Terrill, Jn. of An. Sci. 4:347-358, November, 1945.

48. Heritability of Type and Condition in Range Rambouillet Lambs as Evaluated by Scoring, L. N. Hazel and Clair E. Terrill, Jn. of An. Sci. 5:55-61, February, 1946.

49. The Covariance Analysis of Multiple Classification Tables with Unequal Subclass Numbers. L. N. Hazel. Biometrics Bulletin 2 (2):21-25, April, 1946.

50. Heritability of Face Covering and Neck Folds in Range Rambouillet Lambs as Evaluated by Scoring. Clair E. Terrill and L. N. Hazel. Jour. An. Sci. 5(2):170-179, May, 1946.

53. Effects of Some Environmental Factors on Fleece and Body Characteristics of Range Rambouillet Yearling Ewes. L. N. Hazel and Clair E. Terrill. Jour. An. Sci. 5(4):382-388, Nov., 1946.

*54. Length of Gestation in Range Sheep. Clair E. Terrill and L. N. Hazel. Amer. Jour. Vet. Res. 8(26):66-72, January, 1947.

55. Refining Methods of Using Opal Blue Stain in Evaluating Ram Semen. L. O. Emik and G. M. Sidwell. Jour. An. Sci. 6(1): 67-71, February, 1947.

*57. Range Sheep Improvement Through Selection. Clair E. Terrill, Nat'l Wool Grower 36(12):17-19, December, 1946.

*60. Its the Clean Wool in the Fleece That Pays Off. Elroy M. Pohle, Nat'l Wool Grower 37(5):19-20, May, 1947.

*61. Statistical Treatment of Trichostrongylid Eggs. L. Otis Emik, Biometrics 3(2):89-93, June, 1947.

*62. Factors Affecting the Estimation of Concentration of Sperm in Ram's Semen by the Photoelectrometric Method. L. Otis Emik and George M. Sidwell. Journal of Animal Science 6(4):467-475, Nov., 1947.

64. Tailless Sperm From Rams. L. Otis Emik and George M. Sidwell. In Press, Journal of Animal Science.

*65. Gestation Period in Sheep. Clair E. Terrill and John A. Stoehr. Sheep and Goat Raiser 28(6):23, March, 1948.

67. Effects of Some Environmental Factors on Traits of Yearling and Mature Rambouillet Rams. Clair E. Terrill, G. M. Sidwell and L. N. Hazel. In Press, Journal of Animal Science.

68. Improvement of Sheep for Western Ranges. Julius E. Nordby. To appear as a U.S.D.A. Misc. Publication.

*69. Effect of Feed and Sickness on Wool Growth. Elroy M. Pohle. National Wool Grower. 37(6):9, June, 1947.

*70. High Producing Rams Important. Elroy M. Pohle. National Wool Grower 38(1):21-22, January, 1948.

*71. Fleece Value Increases with Staple Length. Thos. D. Watkins, Jr. For Woolgrowers' Magazines.

*72. Systematic Procedures for Calculating Inbreeding Coefficients. L. Otis Emik and Clair E. Terrill. For Journal of Heredity.

*73. Increasing Efficiency in Selecting Rams. Clair E. Terrill. To be processed by A. H. Div., Bur. of An. Ind., U.S.D.A.

74. The Relation of Face Covering to Lamb Production in Range Rambouillet Ewes. Clair E. Terrill. For Journal of Animal Science.

*75. Activating Genetic Concept into Range Sheep Improvement. Julius E. Nordby, Northwest Science, January-March, 1948.

ABSTRACTS

The following abstracts have been published since the beginning of the Western Sheep Breeding Laboratory in 1937. Those which have also been contributed to by the U. S. Sheep Experiment Station are starred. These abstracts are in general of work that has been or will be published and listed in the regular series of publications.

* 1. Relationship Between Weanling and Yearling Fleece Characters in Range Sheep. Elroy M. Pohle, Jour. of An. Sci. 1(1):60, Feb., 1942.

* 2. The Importance of Body Weight in Selection of Range Ewes. Clair E. Terrill and John A. Stoehr, Jour. of An. Sci. 1(1): 60-61, Feb., 1942.

3. Fineness of Fiber in Eight Sampling Areas on Yearling Rambouillet Ewes. Elroy M. Pohle and R. G. Schott, Jour. of An. Sci. 1(4):356, Nov., 1942.

4. Clean Wool Yield Variation Among Regions of Rambouillet Fleeces. Elroy M. Pohle, H. W. Wolf and Clair E. Terrill, Jour. of An. Sci. 1(4):356, 357, Nov., 1942.

* 5. Estimation of Clean Fleece Weight from Unscoured Fleece Weight and Staple Length. Clair E. Terrill, Elroy M. Pohle and L. Otis Emik, Jour. of An. Sci. 1(4):357, Nov., 1942.

6. A study of the Fiber Density of the Fleeces of Rambouillet Sheep. H. W. Wolf, W. M. Dawson and E. M. Pohle, Jour. of An. Sci. 1(4):357-358, Nov., 1942.

7. Heritability of Yearling Fleece and Body Traits of Range Rambouillet Ewes. Clair E. Terrill and Lanoy N. Hazel, Jour. of An. Sci. 2(4):358-359, Nov., 1943.

* 9. Clean Wool Yields in Small Samples from Eight Body Regions as Related to Whole-Fleece Yields in Four Breeds of Sheep. Elroy M. Pohle and L. N. Hazel, Jour. of An. Sci. 2(4):370, Nov.,1943.

10. Sampling and Measuring Methods for Determining Fineness and Uniformity in Wool. Elroy M. Pohle, L. N. Hazel and H. R. Keller, Jour. of An. Sci. 2(4):371, Nov., 1943.

11. Effects of Some Environmental Factors on the Weanling Traits of Range Sheep. L. N. Hazel and Clair E. Terrill, Jour. of An. Sci. 3(4):432, Nov., 1944.

*12. The Gestation Period of Range Sheep. Clair E. Terrill, Jour. of An. Sci. 3(4):434-435, Nov., 1944.

*13. The Influence of Location and Size of Sample in Predicting Whole-Fleece Clean Yield. Elroy M. Pohle and L. N. Hazel, Jour. of An. Sci. 3(4):452, Nov., 1944.

14. The Etiology and Inheritance of Inequalities in the Jaws of Sheep. Julius E. Nordby, Clair E. Terrill, Lanoy N. Hazel and John A. Stoehr, Anat. Rec. 91(4):30, April, 1945.

15. The Construction and Use of a Selection Index for Range Rambouillet Lambs. L. N. Hazel and Clair E. Terrill. Jour. of An. Sci. 5(4):412, Nov., 1946.

*16. Factors Affecting the Estimation of Concentration of Sperm in Ram's Semen by the Photoelectrometric Method. L. Otis Emik and George M. Sidwell. Anat. Rec. 97(3):69-70, March, 1947.

*19. The Effects of Environmental and Hereditary Factors on Trichostrongylid Worm Infestation on Sheep. L. Otis Emik and Paul W. Gregory. Journal of Animal Science 6(4):477-478, Nov., 1947.

20. The Relation of Face Covering to Lamb Production in Range Rambouillet Ewes. Journal of Animal Science 6(4):479, November, 1947.

SOME OF THE IMPORTANT ACCOMPLISHMENTS OF THE WESTERN SHEEP BREEDING LABORATORY DURING ITS FIRST 10 YEARS ARE LISTED BRIEFLY AS FOLLOWS:

Basic procedure for development of inbred lines of Rambouillets have been worked out.

Methods of calculating inbreeding coefficients have been adapted for use with inbred lines of sheep.

Information has been made available on the etiology and inheritance of inequalities in the jaws of sheep.

It has been demonstrated that many important traits of range sheep can be evaluated at weaning age.

It has been shown that open-face ewes wean more pounds of lamb than covered-faced ewes.

The economic importance of body weight through its relation to lamb production in range sheep has been demonstrated.

The effect of important measureable environmental factors has been determined on weanling and yearling traits in ewes and on all ages of rams.

The heritabilities of weanling traits have been estimated to a workable usefulness.

The genetic and phenotypic relationships among weanling traits have been determined.

Indexes for selecting weanling lambs and rams of all ages have been developed.

Methods for increasing the accuracy of selecting rams have been developed.

The generation length for Rambouillet rams has been decreased by nearly 50 per cent.

The staple length of the Rambouillet flock has been definitely increased.

Skin folds have been practically eliminated from the Rambouillet flock.

The incidence of open face has been increased in the Rambouillet flock.

The rate of genetic improvement has been increased for most important traits in the Rambouillet flock.

Polled lines of Rambouillets have been started.

A non-inbred group to serve as a control to the inbred lines has been initiated.

Basic information on reproduction of range sheep for use in studies of breeding and selection has been collected.

Methods for predicting fertility of rams from semen tests have been developed and improved.

The proportion of ewes lambing has been increased through fertility tests on rams and improved management of ewes.

The per cent of lambs weaned from the Rambouillet flock has been increased by improved management.

A method has been developed and a standard film strip prepared for estimating fineness and variability in wool.

A method for expressing medullation in wool has been developed.

Methods for estimating whole-fleece clean yields from small samples have been perfected.

Methods of sampling fleeces for determining fineness and uniformity in wool have been developed.

It has been demonstrated that fleeces with longer staple have heavier clean weights, lighter shrinks, and greater values.

Cooperation in studies on estimation of wool shrinkage by core test has been active and has yielded marked results.

It has been demonstrated that clean-fleece weights of individual sheep can be adequately estimated from grease fleece weight and staple length for selection in yearling ewes.

It has been shown that hairy lambs at birth produced fleeces approximately equal to those from non-hairy lambs. The hairy condition disappears in the majority of fleeces before shearing.

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Improvements made in the Rambouillet breed at this Laboratory and at State Experiment Stations have clearly brought to light the potential improvement possibilities of the breed as a basic range sheep and have thereby reestablished the ranchmens' confidence in it. This is extremely important because it is a basic economic waste not to take full recognition of genetic truths as they are revealed through basic research when it points the way to production improvement.

PROGRESS IN INBRED LINES OF RAMBOUILLETS

The tenth crop of offspring were added in 1947 to the following table of inbreeding coefficients:

Average Inbreeding Coefficients in Per Cent

Year lambed	Potential inbred lines	Sires	Dams	Progeny	Increase of progeny over dams	Highest for progeny of any pen	Highest for any individual offspring
1938	20	4.0	1.1	3.9	2.8	13.3	37.9
1939	22	7.5	3.2	7.2	4.0	30.3	58.3
1940	34	6.0	3.6	8.2	4.6	32.6	58.3
1941	36	3.3	2.7	8.6	5.9	31.2	47.3
1942	37	4.1	4.0	8.6	4.6	28.7	39.9
1943	30	4.4	4.2	8.9	4.7	23.0	36.9
1944	30	5.0	5.0	10.3	5.3	22.8	48.0
1945	30	6.0	5.8	14.2	8.4	26.8	42.5
1946	30	5.9	7.1	14.1	7.0	25.7	39.4
1947	30	8.6	8.1	15.6	7.5	29.0	55.2

The average inbreeding of all possible progeny increased to 15.6 per cent in 1947. This represents an increase of 11.7 per cent over the first crop in 1938 or an average increase of 1.3 per cent per year.
Only 6 of the sires of the 1947 lambs were not inbred themselves. Slightly less than 99 per cent of the ewes mated were to related rams. The increase in the average inbreeding of sires and dams has been less than 1 per cent per year.

In general the average inbreeding coefficient of all offspring weaned has been about 1% less than that for all progeny given in the above table. The ram lamb offspring saved for breeding are slightly less inbred than all ram lambs weaned and the ewe lamb offspring saved are slightly more inbred than all ewe offspring weaned. The difference is greater for ewe lambs.

The first 6 lines for each of the more important traits are listed in the following table for comparison with similar tables presented in previous years. These lines were ranked on adjusted averages from weanling offspring in 1947. 21 lines were included in the table. 15 of these were included last year and 6 were not. 6 lines (21, 32, 34, 40, 44 and 47) have ranked in the high 6 for one or more traits for each of the last 7 years.

Trait	1st	2nd	3rd	4th	5th	6th
Body Weight	36	25	34	27	29	24
Body Type	29	34	20	37	47	24
Condition	34	21	36	29	27	22
Staple Length	29	47	37	45	39	24
Open Face	40	53	45	50	44	49
Freedom from Folds	23	45	37	24	19	32
Index	40	53	27	25	50	49

In 1938 lines 18 and 19 were formed by dividing pen 4 which had been inbred since 1929. These lines have generally been low in merit and the number of ewes have gradually declined. This year the lines were recombined into one line (19).

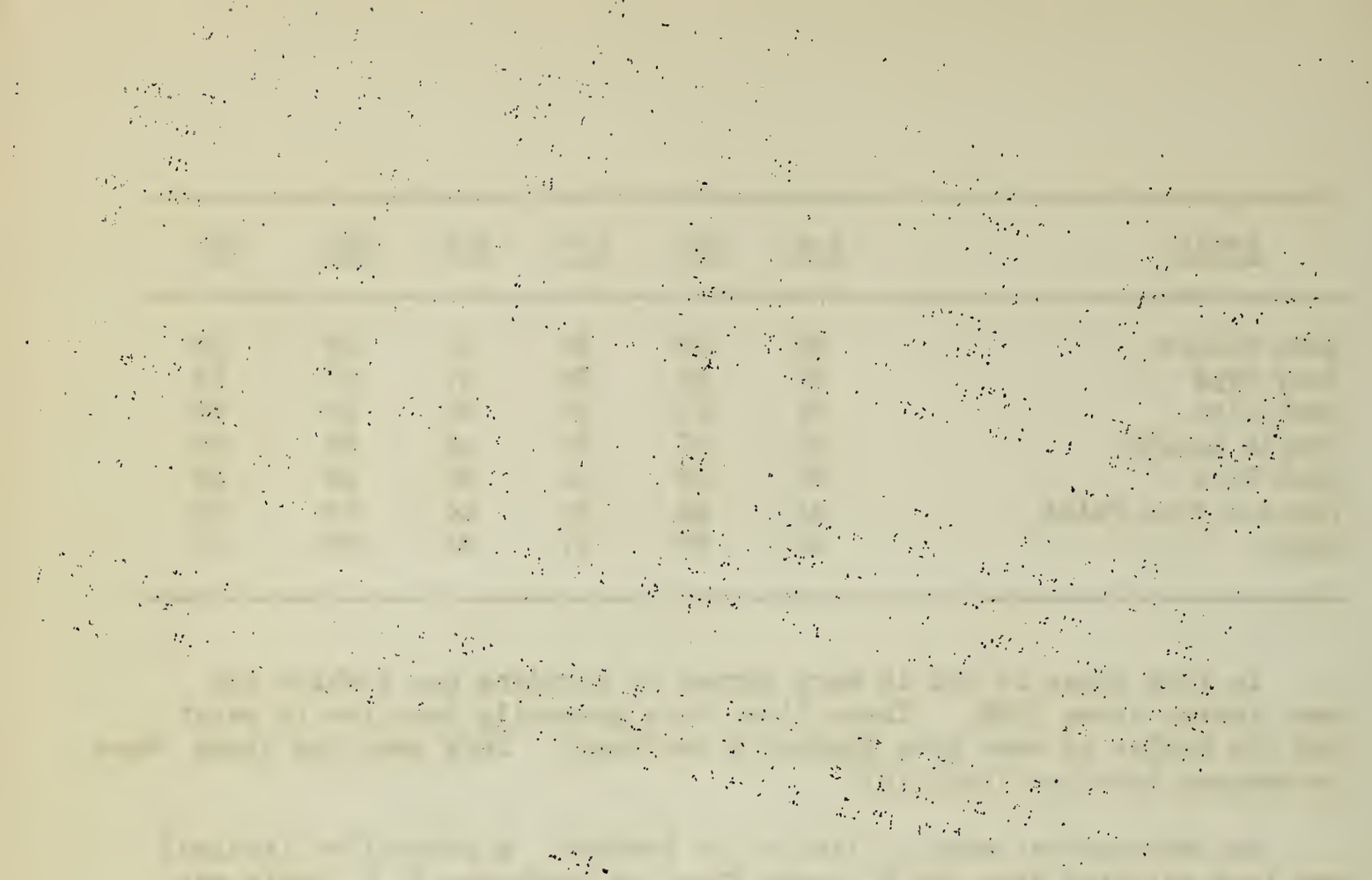
An outcross was made in line 44 in 1947-48. A Debouillet (polled) ram lamb selected from the D. Jones flock by Professor P. E. Neale was used in a test pen in 1946. An outstanding ram lamb without horns was produced from this pen from a ewe tracing to line 44. This ram lamb this was used in line 44 in 1947, chiefly to introduce the polled gene into this line.

NON-INBRED CONTROL GROUP

This breeding group of Rambouillets was initiated in the fall of 1947 to serve as a control group to compare improvement resulting from the utilization of inbred lines. Since the starting of the inbred lines, we have improved our ability to select for production traits and we expect to make still more advancement. We may question, in the future, how much of any improvement resulting from the utilization of the inbred lines could have been made by selection without inbreeding. This non-inbred control group should help answer that question as in this group we will select to the best of our ability and will avoid inbreeding as much as possible.

It may be expected that the inbred lines will be more effective in improving traits which are lowly heritable and more affected by inbreeding, such as type, condition, weaning weight and fleece weight. However, selection alone may be more effective for staple length, face covering and skin folds. This control group should give useful answers to these problems.

It is planned to maintain from 175 to 200 ewes within this group. 5 rams will be used each year to begin with. 174 ewes were selected for the group in the fall of 1947. These ewes were from the "s" series



and resulted from progeny tests of rams from lines on unregistered Rambouillet ewes. All but 5 of the lines were represented by 3 or more ewe offspring of rams from the line. In the first two years a few ewes will be bred to rams from these lines so that all lines will be represented in the control group. Also when any new blood is introduced into any line, as in line 44 this year, a proportionate number of ewes from the control group will be mated to the outside ram. During the first two years rams may need to be selected from the lines for use in the control group. After that the rams used in the control group will be selected from within the group. Ewes were assigned at random to the various rams. The average inbreeding coefficient of all offspring from the control group in 1948 was 1.5%.

LAMB PRODUCTION OF RAMBOUILLET FLOCK

A summary of lamb production for the past 22 years is presented in the following table. The per cent of lambs born and weaned was high for 1946 and low for 1947 as compared with past years. Weaning weights were below average for both years.

Year	No. of ewes bred	Per cent of ewes pregnant	Per cent of lambs born of ewes lambing	Per cent of lambs weaned of ewes bred	Average weaning weight	Pounds of lamb per ewe bred
1924-29	1790	--	--	69.8	72.3	50.5
1930-39	2294	82.3	--	72.9	68.1	49.6
1940	805	87.9	122.0	86.5	79.1	68.4
1941	850	94.3	128.2	92.9	76.2	70.8
1942	1023	90.7	125.3	93.4	75.1	70.1
1943	903	88.0	124.9	91.6	83.4	76.4
1944	908	92.0	129.4	94.3	75.2	70.9
1945	962	91.7	123.4	92.2	69.8	64.3
1940-45	5451	90.8	125.6	91.9	76.3	70.1
1946	890	94.3	134.5	100.7	70.8	71.4
1947	897	90.0	124.1	88.3	70.6	62.4

SELECTION PRACTICED ON RAMBOUILLET LAMBS

Selection differentials for weanling ram lambs were slightly less in 1947 than in 1946 with the exception of weaning weight. The same proportion of ram lambs (26%) was saved in 1947 as in 1946. Selection differentials were greater for ewe lambs in 1947 than in 1946 except for

condition score which remained the same. About 65% of the ewe lambs were retained as compared with 85 per cent in 1946. The selection differentials for Rambouillet weanling lambs in 1947 are presented in the following table:

		Face covering score	Staple length (cm.)	Weaning weight (lbs.)	Type score	Condition score	Neck folds score
Rams	Advantage of selected lambs	.35	.19	6.24	.22	.12	.18
	Relative emphasis	.57	.41	.74	.46	.28	.32
	Expected genetic gain	.196	.076	1.872	.029	.005	.070
Ewes	Advantage of selected lambs	.13	.06	2.10	.11	.08	.13
	Relative emphasis	.21	.13	.25	.23	.19	.23
	Expected genetic gain	.073	.024	.630	.014	.003	.051

The relative emphasis placed on each trait was calculated by dividing the selection differential by the standard deviation for that trait. The greatest emphasis was placed on weaning weight in each sex. In general emphasis was next greatest for face covering followed by type, neck folds, staple length and condition.

The expected genetic gain from selecting ram lambs and ewe lambs was obtained by multiplying the selection differential by heritability for the corresponding trait. These figures are estimates of how much the selected groups are superior in actual breeding value to the unselected groups from which they were chosen. These gains are apt to be increased in later selections, particularly for rams.

The estimated annual genetic improvement from weanling selections would be the sum of the genetic improvement in the ram lambs and the ewe lambs divided by the total age of the parents when the offspring are born. These rates for each weanling trait from 1943 to 1947 are presented in the following table:

Year	Face covering score	Staple length (cms.)	Weaning weight (lbs.)	Type score	Condition score	Neck folds score
1943	.013	.019	.184	.007	.001	.030
1944	.020	.011	.233	.009	.002	.030
1945	.025	.015	.319	.011	.002	.020
1946	.043	.016	.342	.006	.002	.018
1947	.041	.015	.385	.007	.001	.019

These rates have increased for weaning weight and face covering, have remained fairly constant for staple length, type and condition and have decreased for neck folds.

The average age of sires continued to decrease for 1947 but the dams were slightly older. The average age of sires and dams when their offspring are born for 1941 through 1947 are shown in the following table:

Year lambs were born	Average age of dams (years)	Average age of sires (years)	Average age of sires plus dams (years)
1941	4.41	4.00	8.41
1942	4.37	4.13	8.50
1943	4.23	3.63	7.86
1944	4.05	3.38	7.43
1945	4.01	3.40	7.41
1946	3.97	2.70	6.67
1947	4.07	2.43	6.50

The generation length for rams and ewes is about 23 per cent less in 1947 than in 1941 and about 2.5 per cent less than in 1946.

INCREASING ACCURACY OF SELECTING RAMBOUILLET RAMS

It is difficult to balance mentally each trait so that the best ram is always selected. To facilitate this an index has been developed which considers such factors as heritability, economic importance and relationship among traits so as to give maximum genetic progress for overall net merit. The index (I) is based in part on statistics which are estimated or incompletely determined. It will be revised as more reliable information becomes available.

$$I = W - 3G + 11Cl + L + 7T + 4C - 7F - 3N$$

The following table shows the results of applying the index to

adjusted lifetime averages of a group of Rambuillet rams from one line in 1947. It can be seen from the table that 8195W would probably have been chosen for the best ram without the index. This ram was previously selected and used for breeding as a ram lamb. The data presented here show that the choice was wise. The index is not always followed exactly as in this case. Sometimes traits that are not included in the index such as fertility, the polled trait, or a defect such as hair in the fleece must be considered.

Ram No.	G[1]	Cl[2]	L[3]	W[4]	T[5]	C[6]	F[7]	N[8]	Progeny tests year	Progeny tests result	Index	Disposal in 1947
	pounds	pounds	meters	pounds	score	score	score	score				
46W	17.2	8.8	8.3	193	1.8	1.7	3.9	1.9	1945 Ave. 1946 Ave.		233	saved
29W	18.0	8.5	7.9	203	1.6	1.6	4.2	2.3			232	saved
39W	18.6	8.6	8.8	197	1.6	1.6	4.6	1.9			224	culled
92W	17.5	9.3	9.0	190	1.6	1.7	4.8	1.6			228	culled
75W	18.0	9.3	7.9	194	1.8	1.7	4.8	2.2			229	culled
95W	17.4	8.9	8.5	178	1.9	1.7	4.4	1.8			216	culled
95W	16.7	9.1	8.9	198	1.7	1.7	4.2	1.8	1947	Good	241	used

1. G grease fleece weight
2. Cl clean fleece weight
3. L staple length
4. W body weight
5. T type score
6. C condition score
7. F face covering score
8. N neck folds score

IMPROVEMENT OF RAMBOUILLETS THROUGH SELECTION

Summaries of yearling ewe data over a period of 15 years indicate that progress has been made in recent years in improving staple length, freedom from neck folds, type and condition scores. The gains have been compared with estimates of theoretical gains based on selection differentials and generation lengths in 1947, and the best available estimates of heritability. The average annual gains of about 0.02 cm. at weanling age and about 0.04 cm. at yearling age for staple length and of about .13 score at weanling and yearling ages for neck folds were consistent with theoretical genetic gains and therefore probably represent real genetic progress. The annual improvement in freedom from neck folds is now decreasing because most of the possible gain has already been made. Improvements in type and condition scores were far greater than the estimated theoretical genetic

progress and also were not paralleled at weanling age. Thus, the gains in type and condition scores may represent change in scoring standards rather than genetic improvement.

The estimated theoretical genetic progress made from selection for each trait in 1947 was compared with the maximum theoretical genetic progress for that trait if selection were perfect and based on that trait alone. The per cent of maximum progress made range from 29 for condition score to 83 for face covering score. In general slightly over 50 per cent of the maximum possible genetic progress was made for each trait. Of course, these estimates are tentative and will be revised as more basic information is obtained.

EWES WITH OPEN FACES PRODUCE MORE LAMBS

A study was completed during the year on the relation of lifetime lamb production to face covering with 798 Rambouillet ewes born during the years 1938 to 1940.

Ewes with open faces produced 11.3 per cent more lambs and 11.1 more pounds of lamb per ewe bred than those with covered faces. Ewes with partially covered faces weaned 8.6 per cent more lambs and 7.7 more pounds of lamb per ewe bred than those with covered faces. Differences in face covering within these groups was associated with corresponding differences in lamb production. A slight improvement in opening up the faces over completely covered faces resulted in a greater gain in lamb production than the same improvement in partially covered or almost open faces. These advantages for ewes with open faces occurred in spite of three periodic clippings around the eyes of all ewes subject to wool blindness.

Much of the advantage of open-faced ewes was due to a greater number of lambs born per ewe lambing. This accounted for 46 per cent of the advantage of the open-faced ewes; 26 per cent was due to higher weaning weights; 19 per cent was attributed to a higher proportion of the ewes becoming pregnant; and 9 per cent was due to greater viability to weaning of offspring from the open-faced ewes than from those with covered faces.

Open-faced ewes excelled covered-faced ewes in lamb production at each year of age. The greatest advantage for open-faced ewes in pounds of lamb per ewe bred was found at 3 years of age followed in order by 2, 4, 6 and 5 years.

The great economic importance and high heritability of face covering indicate that it should receive as much or more attention in selection than any other trait in sheep where wool blindness is a problem.

EFFECT OF FACE COVERING ON WOOL PRODUCTION

The effect of face covering on lifetime wool production was studied

on 796 yearling ewes born in 1938 to 1940. In addition the effect of face covering on yearling wool production was studied on 1703 ewes born from 1941 to 1946. At yearling age slightly heavier grease fleece weights were produced by covered faced than by open faced ewes. The advantages ranged from 0.16 to 0.45 pound. Ewes with partially covered faces were generally intermediate. A similar advantage of the covered faced ewes was found for clean fleece weight. The advantages ranged from 0.10 to 0.17 pound. In one group the ewes with partially covered faces excelled both open-faced and covered-faced ewes in clean fleece weight. In 2 groups covered-faced ewes had longer staple than open-faced ewes with advantages of 0.08 and 0.37 cm. but in the 3rd group the open faced ewes had 0.03 cm. longer staple. Lifetime (2-6 years) averages of grease fleece weight were greatest for covered faced ewes with an advantage of 0.24 pound over open faced ewes and 0.02 pound over ewes with partially covered faces. The wool production of the open faced ewes was no doubt depressed slightly by their greater lamb production. In any event, the greater lamb production of the open faced ewe is far more important economically (at least 10 to 20 times) than the slight advantage in wool production of the ewe with a covered face.

POLLED RAMBOUILLETS

A total of 331 offspring have been weaned from the 2 polled lines (53 and 54) through 1947. Frequency of offspring from the different matings are shown in the following table:

Parents	Offspring			
	Horned rams	Rams without true horns	Ewes with knobs	Polled ewes
Horned rams x polled ewes	6	10	11	14
Polled rams x ewes with knobs	12	10	9	13
Polled rams x polled ewes	14	111	28	93
	32	131	48	120

The number of ram offspring with horns or ewes with knobs decreased in 1947. One sire did not produce any such offspring. The proportion of offspring which apparently carry the polled gene either in heterozygous or homozygous condition has increased from 58 per cent in 1942 to 87 per cent in 1947. The per cent of ram lambs with horns has decreased from 38 to 5 per cent in the same period. However the proportion of ram lambs with scurs or short horns has increased, the horned rams being replaced with rams with scur growth rather than completely polled rams. Only 12 ram lambs without any scur or horn growth have been produced in

the 6 year period. Two of these have been used in breeding. Two of the 3 completely polled ram lambs born in 1947 were saved for possible use in breeding.

Sires that were completely polled produced fewer rams with horns or ewes with knobs than sires which had scurs or short horns. About 96 per cent of the offspring from completely polled rams carried the polled gene as compared with 72 and 74 per cent from rams with scurs and short horns respectively. However the completely polled rams produced more offspring with scrus or short horns (85%) than rams with scurs (70%) or rams with short horns (72%). With information obtained to date it appears that rams with short horns are no more apt to produce offspring with horns or scurs than are rams with only scurs.

SUPERIORITY IN LAMB PRODUCTION OF RAMBOUILLET EWES HAVING TWINS

A preliminary comparison was made of the lifetime lamb production of 546 ewes which had twins and 1962 ewes which had single lambs. The study included the lifetime lamb production of rambouillet ewes born from 1938 to 1940

Ewes having twins weaned about 48 pounds more lamb per year than ewes having singles. This advantage increased with age up to 5 years, being 25, 33, 40, 50 and 47 pounds for 2 to 6 year-old ewes respectively. The average advantage is high because younger ewes have mostly single lambs whereas a higher proportion of the older ewes have twins.

94 per cent of the twin lambs were born alive whereas 89 per cent of the single lambs were alive at birth. However, 92 per cent of the single lambs born alive were weaned as compared with 82 per cent of twin lambs born alive. The weaning weight of single lambs was 4 to 8 pounds greater than that for twin lambs.

Ewes which produce twin lambs are definitely more profitable than those which produce only single lambs.

FERTILITY STUDIES WITH RAMS

The relationships of different estimates of semen quality in rams differing widely in qualities of semen were investigated, using five ram lambs and seven mature rams with poor qualities of semen, and four mature rams with excellent qualities of semen. Volume, appearance, pH, motility score and per cent, debris score, turbidity, hemacytometer count, counts of live and normal sperm on opal blue smears, methylene blue reduction time and hyaluronidase assay were taken on pooled ejaculates from each ram. The following correlations were most pertinent: turbidimetric concentration vs. hemacytometer count .94; turbidity reading vs. count, .92; methylene blue vs. turbidity, .89, but vs. count, .77; hyaluronidase vs. count, .78, but vs. turbidity, .72; motility per cent vs. per cent live, normal sperm, .86. Repeatability of hyaluronidase assay was .88, after the published methods were improved. Neither hyaluronidase assay nor methylene blue reduction time were significantly related to either the proportion of abnormally formed heads of sperm or abnormally tailled or dead sperm. Hyaluronidase concentration may possibly be related to spermiogenic activity, whereas methylene blue reduction time was influenced by the presence of leucocytes, bacteria, etc. (debris). The ability of laboratory examinations to predict reproductive capacity would not appear to be enhanced by the use of the hyaluronidase assay or the methylene blue reduction time.

Six of the above rams were autopsied, four with semen abnormalities and two normal controls. One ram which had settled 13 of 28 ewes exhibited definite macro-pathology of the epididymis, and micro-pathology of the semen. A second ram with a rare abnormality of the heads of sperm, and which had settled 6 of 12 ewes marked in a band of 40, had testicles approximately half normal size, but appeared normal otherwise. Two more rams with considerable proportions of tailless sperm in ejaculates, not tested for fertility, showed entrance of leucocytes into the semen between the level of the epididymis and the ampulla.

These observations constitute incidental evidence in the search for causes of male sterility naturally occurring in the flock.

SYSTEMATIC PROCEDURES FOR CALCULATING INBREEDING COEFFICIENTS

Inbreeding, combined with improved methods of selection, is proving to be a useful method of improving production traits and scientifically increasing the economic value of a breed. The irregularity of inbreeding systems with sheep creates complex pedigrees not readily analyzed directly by application of Wright's formula for the inbreeding coefficient. Procedures have been developed to simplify, through systematization, the calculation and maintenance of inbreeding coefficients for all sheep at this Station up to date.

The first procedure, termed the sire-ancestor method, is particularly adaptable to pedigree analysis of smaller flocks at any given time. The sire's path-relationships to all of his ancestors are determined, beginning with the farthest removed ancestors. The relation of the parents of an ancestor to the sire are appropriately combined to give the relation of the ancestor to the sire, the process being repeated until the relationship of each parent of the sire is calculated to sire. The sire's inbreeding coefficient calculated from each of these two final relationships provides a final check on the correctness of the calculations. The inbreeding of any offspring is then half the relationship of the parents. The relationship of the sire to any ewe to which he may be mated is the son of the relationship of the sire to ancestors common to the ewe, factored by 0.5 to the power of the number of generations separating ancestor and ewe.

The second procedure, based on a suggestion of Lush, involves the development of relationship charts. These are most useful to follow the inbreeding in inbred lines when relatively small number of females are involved within a line and when inbreeding is to be continued for many generations. The charts are initiated by calculating the interse relationships of all the foundation animals of the inbred line or group to be studied. Ordinary pedigree analysis or the sire-ancestor method are used for this calculation. Continuous charts of relationships are then carried forward relating the descendants to their ancestors and to themselves in a continuous fashion. These charts are constructed on A.H. Form 405 having 48 columns and 60 lines. On the left, the animal's identification numbers, sire, dam and coefficient of inbreeding are recorded in the first four columns. Calculations are carried forward by groups of 30 animals, the first group being related to themselves and 30 additional animals on the first sheet, and 30 more on the next sheet giving 89 relationships per animal. At times up to twice this number of relationships may be necessary if the numbers within generations become very large. The maintenance of inbreeding coefficients for all animals is simple and rapid once the charts are up to date.

EFFECT OF ENVIRONMENTAL FACTORS ON FLEECE FINENESS AND BELLY WOOL

The effect of age of dam, type of birth, year of birth, age at shearing and inbreeding was studied on mean fiber diameter, variability of mean fiber diameter, and covering of belly wool on Rambouillet yearling ewes. None of the environmental factors studied had important effects on mean fiber diameter on its variability. Only 3 per cent of the total variation in each trait was accounted for by the factors studied.

Type of birth, age at shearing and inbreeding had important effects on belly wool. Single lambs were scored as having more covering of wool on the belly than twins or twins raised as singles. The belly wool increased slightly with age at shearing and decreased slightly with inbreeding. All of the environmental factors studied accounted for about 12 per cent of the total variation for belly wool score.

COMMERCIAL GRADES OF RAMBOUILLET FLEECES

There was some increase in the proportion of fleeces grading Fine French combing over 1946 with the exception of mature rams. However, the proportion grading Fine French combing in 1947 was less than from 1942 to 1945 with the exception of yearling rams. There was a reduction in the per cent of fleeces grading 1/2 Blood in 1947.

		Yearling			Mature		
		Fine French (%)	Fine staple (%)	1/2 Blood (%)	Fine French (%)	Fine staple (%)	1/2 Blood (%)
Rams	1942-45	6	92	2	6	92	2
	1946	7	93		4	96	
	1947	9	91		2	98	
Ewes	1942-45	21	75	4	47	50	3
	1946	3	91	6	19	75	6
	1947	9	88	3	33	65	2

SUMMARY FOR INDIVIDUAL GRADE LOTS 1947 CLIP

Lot No.	Description	No. Fl.	Net Gr. Wt.	Clean Yield (%)	Net adj. clean weight (lbs.)	Percent Sort to net grease weight	Shr. (%)	Ave. grease fleece weight (lbs.)	Ave. clean fleece weight (lbs.)	WFA APPRAISAL Value per clean pound	WFA APPRAISAL Total clean value	Ave. clean fleece value	Ave. grease value per lb. Boston	Net grease value per lb. Boston
-1-	#1 Clear	821	7139	47.85	3416	84.40	52.15			$1.38	$4714.08			$0.045**
Fine	#1 Burry (Belly)		281	42.88	120	3.32	57.12			1.13	135.60			
Staple	Paint		173	37.63	65	2.05	62.37			1.06	68.90			
Mature Ewes	Stain		268	37.63	101	3.17	62.37			1.06	107.06			
	Low		63	55.05	35	.74	44.95			1.26	44.10			
	Crutchings		404	37.63	152	4.78	62.37			1.06	161.12			
	Grading Locks		131	37.63	49	1.55	62.37			1.06	51.94			
Totals and Averages			8459	46.55	3938	100.01	53.45	10.22	4.80	$1.34	$5282.80	$6.43	$0.6245	$0.5795
-2-	#1 Clear	397	3379	45.46	1536	85.09	54.54			$1.36	$2088.96			
Fine	#1 Burry (Belly)		186	42.88	80	4.68	57.12			1.13	90.40			
French	Paint		85	37.63	32	2.14	62.37			1.06	33.92			
Combing	Stain		60	37.63	23	1.51	62.37			1.06	24.38			
Mature Ewes	Tags		2	37.63	1	.05	62.37			1.06	1.06			
	Crutchings		195	37.63	73	4.91	62.37			1.06	77.38			
	Grading Locks		64	37.63	24	1.61	62.37			1.06	25.44			
Totals and Averages			3971	44.55	1769	99.99	55.45	10.0	4.46	$1.32	$2341.54	$5.90	$0.59	$0.545
-3-	#1 Clear	444	3092	47.61	1472	85.87	52.39			$1.38	$2031.36			
Fine	#1 Burry (Belly)		175	42.88	75	4.86	57.12			1.13	84.75			
Yearling	Stain		96	37.63	36	2.67	62.37			1.06	38.16			
Ewes	Low		30	55.05	17	.83	44.95			1.26	21.42			
	Tags		101	37.63	38	2.80	62.37			1.06	40.28			
	Grading Locks		107	37.63	40	2.97	62.37			1.06	42.40			
Totals and Averages			3601	46.60	1678	100.00	53.40	8.11	3.78	$1.35	$2258.37	$5.09	$0.6272	$0.5822
-4-	#1 Clear	215	2444	45.18	1104	88.94	54.82			$1.36	$1501.44			
Fine	#1 Burry (Belly)		175	42.88	75	6.37	57.12			1.13	84.75			
Rams	Paint		8	37.63	3	.30	62.37			1.06	3.18			
	Stain		48	37.63	18	1.75	62.37			1.06	19.08			
	Tags		4	37.63	2	.15	62.37			1.06	2.12			
	Grading Locks		69	37.63	26	2.51	62.37			1.06	27.56			
Totals and Averages			2748	44.69	1228	100.02	55.31	12.78	5.71	$1.33	$1638.13	$7.62	$0.5961	$0.5511

** Transportation cost per pound grease wool.

SIGNIFICANCE IN ANNUAL VARIATION IN FLEECE SORTS

There are rather appreciable variations that occur from year to year in the processing of a clip into the various fleece sorts, as per accompanying table. These variations arise from two sources, in the main, and are due to the human element and environmental differences from year to year. It is probable that the environmental differences contribute as much or more to the variations as the human element. The percentage of stained wool, tags, crutchings and grading locks will vary with the condition of the winter feeding grounds and more especially with the bedding ground. The flock's exposure to burrs will also vary some from year to year. The spring range condition before shearing will give rise to variation in dung locks which, if not removed will increase the percentage of stained wool. All of these comprise a part of the flock management in wool production. Attention to them will make it possible to reduce environmental influences to the practical minimum.

It will be noted that in the No. 1 Clear Fine Staple sort that there is a variation during the five years from 75.19 to 89.68 or 14.49 per cent. The difference in value of the fleece, based on the 1947 price is $.39 for the sort involved. The range in total fleece value for the period is $.59 in the Fine Staple, $.19 in the French Combing and $.20 in the Fine Yearling, all based on five pounds of clean scoured wool per fleece. The variation in percentage of off-sorts in another item that gives rise to differences in fleece value.

[illegible]

[illegible]

[illegible]

YEARLY VARIATIONS IN FLEECE OFFSORTS

Wool Type	Description	Per cent Sort to Total					Value per lb.	Value per Fleece Containing 5 Pounds Scoured Wool					
		1947	1946	1945	1944	1943	1947	1947	1946	1945	1944	1943	Range
Fine Staple Mature Ewes	#1 Clear	84.40	75.78	79.48	75.19	89.68	$1.38	5.82	5.23	5.48	5.19	6.19	
	#1 Burry	3.32	11.10	10.58	13.43	3.67	1.13	.19	.62	.60	.76	.20	
	Paint	2.05	4.54	1.71	2.87	--	1.06	.11	.24	.09	.15	--	
	Stain	3.17	1.30*	.94*	2.43*	.84*	1.06	.17	.07	.05	.13	.04	
	Low	0.74	--	--	--	--	1.06	.46	--	--	--	--	
	Crutchings	4.78	5.74	6.08	4.45	4.57	1.06	.25	.30	.32	.28	.24	
	Grading Locks	1.55	1.54	--	--	--	1.06	.08	.08	--	--	--	
	Tags	--	--	1.22	1.62	1.26	1.06	--	--	--	--	--	
Total		100.00	100.00	100.01	99.99	100.02		7.08	6.54	6.55	6.51	6.67	.57
Fine French Combing Mature Ewes	#1 Clear	85.09	74.39	81.14	82.09	89.65	1.36	5.78	5.06	5.52	5.58	6.09	
	#1 Burry	4.68	9.90	8.27	7.87	--	1.13	.26	.56	.46	.45	--	
	Paint	2.14	6.57	2.11	2.56	3.57	1.06	.11	.35	.11	.13	.19	
	Stain	1.51	1.94*	.85*	1.96*	.68*	1.06	.08	.10	.04	.10	.04	
	Low	.05	1.53	--	--	--	1.26	--	.08	--	--	--	
	Crutchings	4.91	5.67	6.36	4.05	4.80	1.06	.26	.30	.33	.21	.25	
	Grading Locks	1.61	--	--	--	--	1.06	.08	--	--	--	--	
	Tags	--	--	1.27	1.47	1.32	--	--	--	.06	.07	.07	
Total		100.00	100.00	100.00	100.00	100.02		6.57	6.45	6.52	6.54	6.64	.19
Fine Yearling Ewes	#1 Clear	85.87	81.02	84.65	71.92	87.56	1.38	5.92	5.59	5.84	4.96	6.04	
	#1 Burry	4.86	5.44	5.56	13.80	--	1.13	.22	.30	.31	.78	--	
	Paint	--	3.85	1.14	3.13	5.36	1.06	--	.20	.06	.17	.28	
	Stain	2.67	7.17*	6.58*	8.00*	4.82*	1.06	.14	.38	.35	.42	.25	
	Low	.83	--	--	--	--	1.26	.05	--	--	--	--	
	Tags	2.80	2.52	2.06	3.16	2.25	1.06	.15	.13	.11	.16	.12	
	Grading Locks	2.97	--	--	--	--	1.06	.15	--	--	--	--	
Total		100.00	100.00	99.99	100.01	99.99		6.63	6.60	6.67	6.49	6.69	.20

* Stained and Low

RELATION BETWEEN STAPLE LENGTH, CLEAN FLEECE WEIGHT, AND VALUE PER FLEECE

A study involving 658 yearling Rambouillet ewe fleeces revealed that as the staple length increases the grease and clean fleece weight increases, shrinkage decreases (with the exception of the group with longest staple), clean fleece increases, and the net value per fleece increases. Evidence for this statement is presented in the following table:

Range in staple length (in.)	Average staple length (in.)	Number yearling ewes	Average grease fleece weight (lb)	Average clean fleece weight (lb)	Clean yield (%)	Price per lb. clean wool (Boston)	Net value per fleece (Boston)
2.0 - 2.3	2.1	70	7.5	3.3	44.0		$4.46
2.4 - 2.7	2.6	325	8.6	3.8	44.3	$1.35	5.13
2.8 - 3.1	2.9	217	9.2	4.1	44.6		5.54
3.2 or more	3.4	66	9.6	4.2	44.1		5.67

PROCESSING FLEECES INTO MAIN AND OFFSORTS

The fleeces of 82 "RW" (registered) and 196 "W" (unregistered Rambouillet yearling ewes were sorted into main sorts and offsorts, and record w as made of all sorts promptly after shearing of the flocks in June, 1948. Preliminary examination of the data, as summarized in the two following tables, and methods of procedure would seem to indicate that the variability of fleeces in "RW" and "W" was not different from the within fleece variability (main-sort ÷ off-sort ratio). Worker differences were present for amounts of sorts and types of sorts. Records by workers were taken only a few fleeces apiece, but observation of the data as it was recorded gave the impression of worker differences with Rambouillet fleeces.

MAIN SORTS AND OFF SORTS FROM 278 RAMBOUILLET YEARLING EWE FLEECES IN LBS.

Breed	Orig. Grade	3*	4	5	6	7	8	11	12	14	17	20	TOTAL
"RW"	1/2	12.93	0	37.97	2.13	1.66	.37	4.11	0	2.23	.11	.07	61.58
	FS	510.18	36.95	83.01	10.39	0	0	64.35	0	19.78	1.02	0	725.68
TOTAL		523.11	36.95	120.98	12.52	1.66	.37	68.46	0	22.01	1.13	.07	787.26
"W"	1/2	7.99	0	79.86	7.02	.80	0	7.82	0	2.12	.05	.04	105.50
	FS	1214.36	89.53	184.04	31.21	.65	0	151.21	.25	43.27	3.92	0	1718.22
	F Fr	0	26.29	1.26	.39	0	0	3.29	0	1.01	0	0	32.24
TOTAL		1222.15	115.82	265.16	38.62	1.45	0	126.32	.25	46.40	3.97	.04	1856.18

MAIN SORTS

* 3. Fine Straight Combing (64s)
4. Fine French Combing (64s)
5. 1/2 Blood (60s & 62s)
6. 3/8 Blood (56s & 58s)
7. 1/4 Blood (48s & 50s)
8. Low 1/4 Blood (46s)

OFF SORTS

11. Burry Fine & 1/2 Blood (60s to 70s & Finer)
12 Burry 3/8 Blood & 1/4 Blood (48s to 58s)
14. Stained Fine & 1/2 Blood (60s to 70s & Finer)
17. Paint Fine & 1/2 Blood (60s to 70s & Finer)
20. Tags

SUMMARY OF WEIGHTS OF SORTS OF YEARLING RAMBOUILLET EWE FLEECES

Breed	Fleece grade	No. of fleeces	Main-sorts	Off-sorts	Total	Main sort percentage of fleece
"RW" *	1/2	6	9.02	0.85	9.87	91.4
	F.S.	71	8.49	1.15	9.64	88.1
	F.F.	5	7.76	1.05	8.81	88.1
TOTAL		82	8.48	1.12	9.60	88.4
"W" *	1/2	19	8.78	1.05	9.83	89.3
	F.S.	161	8.42	1.10	9.52	88.4
	F.F.	16	7.53	0.98	8.51	88.5
TOTAL		196	8.38	1.09	9.47	88.5

* "RW" - Registered series of Rambouillets and "W" - unregistered series of Rambouillets.